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AUTHOR Robinson, Karlen
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ABSTRACT

Of particular interest to those exploring students' learning modalities is the relationship between the visual and auditory systems and reading recall. Among the findings of studies that have investigated this relationship are the following: (1) reading competency is dependent as much on auditory processing as on visual processing; (2) when visual and auditory signals are presented simultaneously, subjects generally respond to the visual input and are often unaware that an auditory signal has occurred; (3) auditory stimuli are processed more rapidly than visual stimuli; (4) when preschool children's evaluation and integration of visual and auditory information was compared with that of adults both groups were found to have available continuous and independent sources of information; (5) memory training increases a child's ability to retain stimuli; (6) under audio/video mismatch conditions, memory for audio information is reduced more than memory for video information; however, comprehension and recognition of audio information is similar in the audio only and audio/video match conditions; (7) children recall logical sequences better than illogical ones; and (8) children of all ages show a correspondence between strategy use and metamemory as assessed by verbalization of relationships among pictures during specific questioning; however, when a more typical general question format is used to assess metamemory, strategy use precedes verbalized knowledge of strategy use. In general, most studies show that visual stimuli tend to dominate other modalities in both perceptual and memory tasks. A three-page list of references concludes the document. (HOD)

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VISUAL AND AUDITORY MODALITIES AND READING RECALL: A REVIEW OF THE RESEARCH

Karlen Robinson

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VISUAL AND AUDITORY MODALITIES AND READING RECALL: A REVIEW OF THE RESEARCH

Karlen Robinson

Recently there has been an interest in the quality of education in American public schools. These concerns were reflected in such national reports as "Nation at Risk" and "Action for Excellence". With emphasis to improve education, educators have studied the learning modalities of students. Of particular interest was the effectiveness of oral and visual stimuli to enhance learning.

Raney (1984) stated the relationship between the visual and auditory systems within one individual has received little direct attention. Although the bulk of the literature suggests auditory-visual independence, some literature suggests the possibility of correlated auditory-visual systems. In terms of auditory-visaul independence, Murch (1973) pointed out major differences in the auditory and visual systems in terms of sensory processing, sensory organization, information retention, and time requirement for adequate perception. He concluded that the evidence for separate mechanisms of visual and auditory information processing is strong. Walden, et. al. (1975) further explored the visual contributions to consonant recognition and concluded that the "absolute contributions of visual cues in audiovisual consonant recognition is essentially unrelated to auditory performance level.

Lendau et. al. (1974) found statistically significant correlations between subjects' absolute judgements of loudness (auditory task) and brightness (visual task), and suggested some relationship between the two systems.

Richie and Aten (1976 investigated the ability of children to retain auditory stimuli presented serially. The results suggested that reading competency is dependent as much on auditory processing as on visual processing. The importance fo the relationship between auditory processing skills and reading ability and how critical the retention of auditory information is to the act of reading remain to be determined.

Roth (1977) identified and criticized Turvery's (1977) theory on visual information processing. The visual information processing models of indirect realists were held to be implausible because their postulated comparison processes presuppose knowledge of just those identity relations and transformations that are required to perform compariosons. The claimed logical circularity is refuted by explaining how matching processes can identify both identity and transformation relations simultaneously. Turvey (1977) contended that information processing models must be restricted to discontinuous processing of static snapshots. Roth (1977) believes the claim is over-stated and easily rejected. Most crucially, Turvey contended that perception is explainable as the result of the direct pickup of invariant properties in the flux of light at they eye. Roth (1977) states in view of recent advances in the understanding algorithmic complexity, consideration of a simple triangle recognition proble suggests that the supposed direct recognition capacities are both infeasible and implausible.

Shepard's (1967) study compares recognition performance when different types of target material were used. In this experimental study, words, original sentences, and pictures were presented to

subjects with such presentation followed by a two-choice recognition test. Results indicated that the average percentage of correct recognition for the three types of material was 88% words, 89% for sentences, and 97% for pictures. Zechmeister and Nyberg (1982) described this study as a "classic" and Hintzman (1978) wrote retention of words and sentences was remarkably good but that of pictures was phenomenal.. Pick, Warren and Hay (1969) also found in a location task that vision tended to dominate auditory location information.

Colavita (1974) conducted a series of experiments. In general, they found that when visual and auditory signals were presented simultaneously, subjects generally responded to the visual input and are often unaware that an auditory signal had occurred. Colavita first asked his subjects to match a visual and auditory stimulus for subjective intensity. These matched stimuli were than used in a choice reaction time task. Subjects were instructed to press one key whenever a light came on and another key whenever a tone occurred. Each of the 10 subjects received 30 trials. On 5 of these trials, both light and tone were presented simultaneously. He found that in 49 out of 50 conflict trials, busjects responded only to the light. When subjects knew that dual presentaions could occur, visual dominance was still present, although reduced.

Several different methods have been used to assess the dominant processing modality. One technique is to determine whether the participants learn better with pictorial or verbal material Levin et. al. (1974); Richardson (1978). A more traditional paradigm in cognitive research is the Brown_Peterson method Brown(1958); Peterson and Peterson(1959) in which a distractor is presented between

the stimulus and recall opportunity. As a rationale for this paradigm, Kroll and Parks (1978) concluded that when a visual stimulus is actively attended to, a visual memory code cannot be maintained in an active state. It follows from this that if an individual remembers a stimulus after attending to viaual interference, the stimulus must have been processed auditorily. Conversely, if the stimulus is remembered following auditory interfernce it must have been processed visually. Serveral researchers have used variations of this technique to assess auditory and visual coding modality in children Burton (1982); Pellegrino, Siegel, and Dhawan (1976).

The intersensory facilitation paradigm was used to investigate the alerting characteristics of visual and auditory stimuli, Nissen (1974). In one experiment, the subject's task was to decide whether an X appeared to the right or the left of the fixation frame. On four-fifths of the trial the visual imperative stimulus was accompanied by an auditory accessory (a burst of white noise). In another experiment, the imperative stimulus was either visual or auditory. An X could appear on the right or the left of the fixation frame, or a tone could be presented to the right or left ear. The subject pressed the right key when either the X or the tone was on the right, and the left key when either of the stimuli was on the left. On four-fifths of the trials, there was a visual accessory stimulus, consisting of a square flash of light in the center of the fixation frame. The accessory could precede or follow the imperative stimulus by up to 100 sec..

He compared the effects of a visual accessory on a visual task, a visual accessory on an auditory task, a d an auditory accessory

on a visual task. It appears that an auditory accessory was more effective than a visual accessory in reducing reaction time to the imperative stimulus. When an auditory accessory and a visual imperative stimulus occured stimultaneously, reaction time was reduced by about 40 sec.. However, when a visual accessory occurred at the same time as either a visual or auditory imperative stimulus, little or no facilitation occurred. Neither the 5 msec. reduction of mean reaction time on the visual task nor the 12 msec. reduction on the auditory task was significant.

The auditory accessory stimulus produced a very clear effect on visual processing throughout the range of intervals studied. The effect porduced was a reduction in reaction time together with an increase in errors. This trade off is exactly what occurs with increases in alertness introduced by warning signals Posner (1976). The visual accessory affected porcessing only when it preceded the imperative signal. The usual explanation of this asymmetry attributes it to the fact that auditory signals are processed more rapidly than visual signals. An auditory accessory affected a visual task even when it occurred together with or following the visual signal but the reverse did not occur.

Oden and Massaro (1978) completed a study with preschool children. Preschool children's evaluation and intergration of visual and auditory information is speech perception were compared with that of adults. The subjects identified speech events, which consisted of synthetic speech syllables ranging from /ba/ to /da/ combined with a videotaped /ba/, /da/ or no articulation. Both variables influenced the identification judgment for both groups of subjects.

The results were used to test current views of the development of perceptual categorization and speech perception. Tests of quantitative models indicated that both preschool children and adults had available continusus and independent sources of information. The results were well described by a "fuzzy" logical model of perception, which assumes that the perveiver integrates continuous and independent sources of information and determines the relative goodness of match to prototype difinitions in memory. The only developmentla difference was less of an influence of the visual source of information for children relative to adults..

Mullin (1984) completed a study to determine whether specific auditory and visual memory trainging improves the ability of kindergarten children to retain auditory and visual stimuli. Auditory and visual pretests were administered. The children were involved in auditory and visual memory training activities for 15 min. sessions for 25 days. Following the training, auditory and visual posttests were administered; the pre and post test scores were compared. The results supported the notion that memory training does increase a child's ability to retain stimuli.

A study was done to examine the relationship between children's cognitive processing of video and audio information on television. Pezdek, and Stevens (1984) had ninety-six 5 year old children viewing taped segment of Seame Street followed by a comprehension test and a recognition test. Equal numbers of subjects viewed an experimental segment in which the audio and video tracks were from the same segment (A/V match), the audio and video tracks were not from the same segment (A/V mismatch), and the video and the audio

tracks were presented independently. This design permitted unconfounded comparisons of modality specific processing. The results showed under the A/V mismatch conditions, memory for audio information was reduced more than memory for video information. However, comprehension and recognition of audio information was similar in the audio only and A/V match conditions. These results suggested that regular television (video) programs, the information did not interfere with processing the audio information instead, the video material simply appeared to be more salient and more memorable than the audio material.

Need (1985) investigated the relationship between auditory and visual processing modality and strategy instructions with first and second grade children. A Pictograph Sentence Memory Test was used to determine dominant processing modality as well as instructional effects. The pictograph task was given first followed by auditory or visaul interference. Children who were disrupted most frequently by visual interference were classed as visual processors and those most frequently disrupted by auditory interference were classed as auditory processors. Auditory and visual processors were then assigned to one of three conditions: interactive imagery strategy, sentence strategy, or a control group. Children in the imagery and sentence strategy groups were briefly taught to integrate the pictographs to facilitate retention. It was found that the sentence strategy was effective for both auditory and visual processors, whereas the interactive imagery strategy was effective only for auditory processors.

Relationship between verbalized knowledge (metamemory), strategy use, and performance were examined by Cantor (1985) in a memory task for visually presented episodes. Kindergarten, second grade, and fifth grade students were asked to reconstruct a sequence of pictures that formed an episode from an array of original pictures and foils. The episodes varied on two dimensions--materials types and the logic of the sequence. Materials were either typical (familiar animal characters and scenes) or atypical (geometric figures) story materials. Sequences either readily conveyed a story (logical) or were rearranged to present a random ordering of pictures (illogical). Children were questioned about their use of a story line to help remember the picture sequence (general questioning) and were asked more specific questions concerning the reasons for their picture selection during the task (specific questioning). Children of all age levels recalled logical sequences better than illogical ones. Second and fifth grade children recalled animal episodes better than geometric form episodes. Children of all ages showed a correspondence between strategy use and metamemory as assessed by verbalization of relationships among pictures during the specific questioning. However, when the more typical general question format was used to assess metamemory, strategy use preceded verbalized knowledge of strategy use.

The literature reveals a vari ation of theories, case studies and experiments in relation to visual vs auditory stimuli, the relate to memory and recall. The majority of studies showed that visual stimuli tended to dominate over other modalities in both perceptual and memory tasks (Posner, Hissen, and Klein, 1976).

References

Burton, J. K., Dual Coding of Pictorial Stimuli by Children. Journal of Mental Imagery, 1982, Vol. 6, pp159-168.

Cantor, D.S., et al, Organization in Visual Episodic Memory; Relationships between Verbalized Knowledge, Strategy Used, and Performance. Journal of Experimental Child Psychology, 1985, Vol. 40, pp 218-232.

Colavita, F.B., Human Sensory Dominance. Perception and Psychophsics, 1969, Vol. 6, pp. 203-205.

Hintzman, D.L., The psychology of learning and memory. San Francisco; Freeman, 1978, pp. 232.

Krolls, N.E.A., Parks, T.E., Interference with short-term visual memory produced by concurrent central processing. Journal of Experimental Psychology, Human learning and Memory, Vol. 4, 1978, pp. 111-119.

Lendau, S., et al., Individual differences and reliablity of information transmission in absolute judgements of loudness, brightness, and line lengths. Perception and Motor Skills, 1974, Vol. 39, pp. 239-241.

Levin, J.R., Divine-Hawkins, P., Kerst, S. M., Individual differences in learning from pictures and words. Journal of Educational Psychology, 1974, Vol. 66, pp. 296-303.

Mullin, Linda., Lange, Una A., Does the ability of kindergarten children to retain auditory and visual stimuli improve with training? Language, Speech, and Hearing Services in the Schools, 1984, Vol. 15, pp. 210-15.

Massaro, D.W., Children's Perception of Visual and Auditory Speech. Child Development, 1984, Vol. 55, pp. 1777-1788.

Murch, G., Visual and Auditory Perception. Journal of Speech and Hearing Disorders, 1973, Vol. 40, pp.481-492.

Peterson, L. R., & Peterson, M.J., Short-term retention of individual verbal items. Journal of Experimental Psychology, 1959, Vol. 58, pp. 193-198.

References (cont.)

Pezdek, Kathy; Stevens, Ellen, Children's Memory for Auditory and Visual Information on Television. Developmental Psychology, Vol. 20, 1984, pp. 212-218.

Pick, H.L., Sensory conflict in judgement of spatial direction. Perception and Psychophsics, 1969, Vol. 6, pp. 203-205.

Posner, M,I., Nissen, M.J., and Klein, R.M., Visual Dominance: An Information-processing Account of its Origins and Significance. Psychological Review, 1976, Vol. 83. pp. 157-171.

Raney, Lynne; and Others, Correlation between Auditory and Visual Performance on Two Special Reception Tasks. Volta Review, 1984, Vol. 86, pp. 134-141.

Richardson, J.T.E., Mental imagery and memory: Coding ability or coding perference? Journal of Mental Imagery, 1978, Vol. 2, pp. 101-116.

Richie, D. J., Aten, J.L., Auditory retention of nonverbal and verbal sequential stimuli in children with reading disabilities. Journal of Learning Disabilities, 1976, Vol. 9, pp. 312-318.

Roth, F., Critique of Turvey's "Contrasting Orientations to the Theory of Visual Information Processing". Psychological Review, 1977, Vol. 84, No. 6, pp. 531-535.

Shepard, R.N., Recognition memory for words, sentences and pictures. Journal of Verbal Learning and Verbal Behavior, 1967, Vol.6, pp. 156-163.

Turvey, M.T., Contrasting orientations to the theory of visual information processing. Psychological Review, 1977, Vol. 84, pp.67-88.

Walden, B., Prosek, et. al., Auditory and audiovisual feature transmission in hearing-imparied adults. Journal of Speech and Hearing Research, 1975, Vol. 18, pp. 272-280.

References (cont.)

Weed, K., Ryan, E., The Effectiveness of Imagery and Sentence Strategy Instructions as a Fuction of Visual and Auditory Processing in Young School-Age Children. Journal of Experimental Child Psychology, 1985, Vol. 40, pp. 548-561.

Zechmeister, E.B., Nyberg, S.E., Human Memory. Montery, California; Brooks/Cole, 1982.